A Pedagogical MTConnect Module to Improve Scaffolded Active Learning in Manufacturing Engineering Education

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Recent interest in improving pedagogical approaches in science, technology, engineering, and mathematics (STEM) fields has stimulated research at many universities. It is found that there is an essential need to identify and overcome the STEM educational challenges. Thus, this proposal aims to support student learning in manufacturing engineering through continuous machine monitoring and real-time process evaluations. A pedagogical framework is presented as an idea that can assist engineering educators in developing MTConnect learning modules in both academia and industry communities. Manufacturing education requires engagement of students and engineers in psychomotive learning to facilitate content comprehension, connect learning goals, and clarify the subjects. Advances in sensor technologies and development of standards in smart manufacturing have made it possible to retrieve real-time data efficiently from machine tools. The proposed framework is applied to develop a participatory pedagogy for manufacturing courses through the use of computer numerical control of manufacturing operations and MTConnect as a machine interoperability standard for real-time monitoring, visualization, and data analysis of machine energy use. The framework has been applied for graduate manufacturing engineering course at University of California (UC), Berkeley. It is found that the framework can effectively support MTConnect learning module development in manufacturing engineering education.